

*DESCRIPTIVE ANALYSES OF PEDIATRIC FOOD REFUSAL
AND ACCEPTANCE*

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Functional analyses of inappropriate mealtime behavior typically include conditions to determine if the contingent delivery of attention, tangible items, or escape reinforce food refusal. In the current investigation, descriptive analyses were conducted for 25 children who had been admitted to a program for the assessment and treatment of food refusal to determine if the consequences commonly delivered during functional analyses were observed during parent-conducted meals. The conditional probabilities for the delivery of attention, tangible items, and escape following food refusal and acceptance were compared to the unconditional probabilities of each event. Results showed that attention and escape most frequently followed refusal and differed depending on the topography of refusal. Implications for further evaluations of food refusal using similar methods are discussed.

Key words: conditional probabilities, descriptive analysis, pediatric feeding disorders

Descriptive analyses (Bijou, Peterson, & Ault, 1968) frequently have been used to obtain information on interactions between events in naturalistic settings. Even though descriptive analyses cannot be used to identify functional relations between behavior and environmental events (Iwata, Kahng, Wallace, & Lindberg, 2000), evaluations of common antecedents and subsequent events observed during typical routines might inform the types of contingencies that are arranged in experimental functional analyses (Piazza, Fisher, et al., 2003). This general logic has been applied previously to

evaluations of problem behavior and possible contingencies of reinforcement (e.g., Anderson & Long, 2002; Lerman & Iwata, 1993; McKerchar & Thompson, 2004; Thompson & Iwata, 2001; Vollmer, Borrero, Wright, Van Camp, & Lalli, 2001).

Vollmer et al. (2001) conducted unscripted descriptive observations in an inpatient setting for 11 individuals with developmental disabilities who engaged in severe problem behavior (e.g., self-injury, aggression). Data were collected on both participant and caregiver responses to evaluate the likelihood of events commonly tested during functional analyses (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), including attention from caregivers, access to tangible items, and removal of instructional demands, following severe problem behavior. A subsequent comparison of conditional probabilities of these events suggested that potential contingencies of reinforcement between behav-

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ior and environmental events had been identified.

Thompson and Iwata (2001) conducted descriptive analyses for 27 adults with severe problem behavior to determine if caregiver attention, access to tangible items, and escape followed instances of problem behavior in a residential facility for persons with various disabilities. The researchers conducted observations and collected data on participant and caregiver responses and analyzed data to calculate conditional probability values for each event following problem behavior. Results showed that the most common event observed following problem behavior was attention, although escape from instructional demands was observed as well, and the delivery of tangible items was observed least often. Thompson and Iwata also found that attention and escape were more likely to follow aggression compared to other topographies of problem behavior (e.g., disruption), and that the likelihood that tangible delivery followed problem behavior was relatively low. These results provide support for the use of experimental functional analyses (as described by Iwata *et al.*, 1982/1994) given that these commonly assessed antecedent and consequent relations were observed during naturally occurring interactions. In addition, these results underscore potential differences between the likelihood of particular environmental events and the form of problem behavior.

Piazza, Fisher, *et al.* (2003) conducted descriptive observations of caregivers and children who exhibited inappropriate mealtime behavior (e.g., batting the spoon, turning head). Results from the descriptive analyses showed that parents responded to inappropriate behavior by providing escape from bite presentations, access to attention (e.g., coaxing, reprimands), and access to leisure items and preferred foods. However, the results from the descriptive analyses did not include the conditional probability values of various forms of attention,

tangible delivery, and escape, or the probability values for those events following separate topographies of inappropriate behavior.

Piazza, Fisher, *et al.* (2003) then conducted experimental functional analyses with conditions that included therapist delivery of events following inappropriate mealtime behavior that were based on those observed during the descriptive analyses. Escape, attention, and tangible conditions of the functional analysis were compared to a control condition. Results of the functional analyses demonstrated that escape from food presentation was the most common function (9 of 13 cases), with attention the second most common (*i.e.*, 8 cases) and access to tangible items the least common (*i.e.*, 2 cases). In addition, more than one behavioral function was identified for most cases, suggesting that attention and escape may be important variables to consider when designing interventions. Additional research in this area has also shown that escape from food presentation is frequently identified as a reinforcer for inappropriate mealtime behavior (Girolami & Scotti, 2001; Najdowski, Wallace, Doney, & Ghezzi, 2003) and that escape extinction is often a necessary component of an effective treatment package (Bachmeyer *et al.*, 2009; Cooper *et al.*, 1995; Piazza, Patel, Gulotta, Sevin, & Layer, 2003; Reed *et al.*, 2004; Wilder, Normand, & Atwell, 2005).

Even though some research has included descriptive methods as a component of food refusal assessments (e.g., Piazza, Fisher, *et al.*, 2003), an evaluation of conditional probability values for caregiver responses following food refusal and acceptance could provide relevant information on the delivery of potential reinforcers for food refusal. Although escape from the mealtime situation is most frequently identified as a function for refusal, the data from Piazza, Fisher, *et al.* also showed that inappropriate mealtime behavior might be sensitive to multiple environmental contingencies (e.g., parent attention, tangible items).

Moreover, treatments for feeding disorders often include an escape extinction component in addition to components that eliminate the response–reinforcer relation between food refusal and attention and food refusal and access to tangible items. Thus, although escape has been clearly indicated to play a role in the maintenance of inappropriate mealtime behavior, the extent to which other environmental events are associated with these behaviors is largely unknown. Therefore, the purpose of the current investigation was to extend the results of Piazza, Fisher, et al. by conducting descriptive analyses with a relatively large number of participants to determine if (a) the consequences provided following food refusal during test conditions of functional analyses of inappropriate mealtime behavior were observed during descriptive analyses (parent-conducted meals), (b) subsequent events were more likely to follow food refusal than food acceptance, and (c) subsequent events (parent responses) were more likely to occur following specific topographies of food refusal. This was accomplished by evaluating specific forms of attention (e.g., reprimand, praise), escape (e.g., spoon removal), and delivery of tangible items (e.g., presentation of previously consumed foods) following children's food refusal and food acceptance.

METHOD

Participants and Setting

Twenty-five children who had been admitted to an inpatient or intensive day-treatment program for the assessment and treatment of severe food refusal (i.e., liquid or gastrostomy [G]-tube dependence) or selectivity (i.e., the child consumed only a few foods and refused all others) and their parents participated. The children (17 boys and 8 girls), ranged in age from 1 year 5 months to 8 years 2 months. Table 1 provides specific information for each child and includes the food refusal responses observed for each participant. Twenty-six

parents (4 men and 21 women) participated; they ranged in age from 22 years to 49 years ($M = 40$ years).

Following admission to the program, we conducted descriptive analyses for each child and his or her parent using procedures similar to those described by Vollmer et al. (2001). Parents conducted sessions in treatment rooms equipped with a table, chairs, a high chair or Rifton chair for the participant, and one-way observation. The parent placed the child in a chair, a high chair, or a Rifton chair based on parental selection. The therapist told the parent that he or she was being observed, and all sessions were videotaped. The therapist provided the parent with foods that the child had consumed previously as well as those that the child reportedly refused or recently eliminated from his or her diet (i.e., foods that were preferred at one time but the child no longer consumed). If the parent requested additional items such as toys and videos, the therapist provided these items based on parental report of child preference, or the parent provided the child with items brought from home. These items were not provided unless the parent requested them during meals. The therapist instructed the parent to feed his or her child as he or she would at home and provided no specific instructions about the frequency of bite presentation or the food or drink to present during the meal. Observation duration was determined by naturally occurring meals (i.e., the parent determined how long the meal lasted) or the passing of 1 hr, whichever occurred first. Although some children were nasogastric (NG)- or G-tube dependent, they all had a history of accepting at least one food or drink orally, even in small amounts.

Response Topographies

Children's behavior. Data collectors scored each topography of food refusal separately as a frequency measure and included *disruptive behavior*, defined as batting the spoon or cup, pushing the food or drink away, turning of the

Table 1
Participant Information

Participant	Gender	Age (years-months)	Diagnoses	Inappropriate mealtime behavior
Annabella	F	1-8	Williams syndrome, developmental delay (DD), food allergies	Disruption, gagging or coughing, emesis
Earl	M	5-9	Autism (AUT), gastroesophageal reflux (GER), food allergies, G-tube, dysphagia	Disruption, retching
Gigi	F	2-10	Pierre Robin sequence, GER, failure to thrive (FTT), DD, food allergies, G-tube, cleft palate repair	Disruption, expelling food, SIB
Giles	M	4-5	Enlarged tonsils or adenoids (ETA), ear infections, DD	Disruption
Greta	F	2-10	GER, FTT, G-tube	Disruption
Jax	M	2-6	GER, FTT, G-tube, delayed gastric emptying (DGE)	Disruption, gagging, emesis
Jonas	M	4-0	GER, DD, lung disease	Disruption, expelling food
Jett	M	2-1	GER, DD, chronic diarrhea	Disruption
Jesper	M	4-11	GER, DD	Disruption, gagging or coughing
Johnny	M	6-1	AUT, GER	Disruption, gagging, emesis
Joakim	M	1-7	GER, FTT, G-tube	Disruption
Kiki	F	6-5	PDD-NOS, GER, FTT, G-tube, dysphagia	Disruption
Mia	F	8-2	Urea cycle disorder, DD, NG-tube	Disruption, elopement
Navarone	M	1-5	FTT	Disruption, gagging, expelling food
Neema	F	5-11	GER, G-tube	Disruption, gagging or coughing, emesis
Nico	M	8-3	Down syndrome, GER, DD	Disruption, aggression, SIB
Preston	M	1-11	Down syndrome, GER, DD, G-tube	Disruption, expelling food, aggression
Pedro	M	4-9	Down syndrome, GER, DD, food allergies	Disruption, SIB
Rufus	M	2-10	Crohn's disease, GER, food allergies	Disruption
Sully	M	5-2	AUT, GER, DD	Disruption, gagging or coughing, SIB
Sophie	F	1-5	GER, FTT, DGE	Disruption, gagging or coughing, emesis
Tobias	M	1-9	GER, NG-tube, food allergies	Disruption
Wright	M	1-10	Schachman Diamond syndrome, FTT	Disruption, gagging or coughing, expelling food
Wyatt	M	7-9	Down syndrome, DD	Disruption
Zita	F	3-2	GER, G-tube	Disruption, gagging or coughing

head, covering of the mouth, and negative vocalizations (e.g., screaming, saying “no” or “I don’t like this”); *gagging or coughing*, defined as the child retching with movement of the chest and stomach or expelling air from the lungs sharply with a noise; *expulsions*, defined as spitting out the food or drink; and *emesis*, defined as the contents of the stomach (e.g., partially digested food, liquids, or mucous) passing the plane of the lips (i.e., vomiting). In addition, observers collected data on *problem behavior*, including aggression (hitting or kicking another person) and self-injurious behavior

(SIB; hits to the head with a closed or open hand).

Observers also collected data on appropriate mealtime behavior, which was scored as a frequency measure and included *acceptance*, defined as the child allowing food to be deposited into his or her mouth, or the child depositing food into his or her mouth without physical assistance from the parent; and *sips*, defined as the child allowing liquid to be deposited into his or her mouth or depositing liquid into his or her mouth without physical assistance from the parent. Data collectors

scored acceptance if the child did not accept all of the food on the spoon; thus, it was possible that some food still remained on the spoon even though acceptance was scored.

Parents' behavior. Throughout all sessions, trained observers collected data on specific parental responses (i.e., subsequent events) that could potentially function as reinforcers for food refusal. These included *attention* (coaxing, threats, reprimands, statements of comfort or concern, and praise), *escape* (spoon or drink removal, allowing the child to leave the table, and termination of the meal), and *tangible delivery* (delivery of leisure items, switching to a previously consumed food, switching to a drink following food presentation, and switching to food following drink presentation). Observers scored all events concurrently, and multiple events could be scored at the same time. For example, it was possible that a parent presented a novel food and the child refused, resulting in the parent removing the spoon and presenting a previously consumed food. In this instance, data collectors scored spoon removal and switching to a previously consumed food separately.

To calculate conditional probability values for different events, observers scored specific forms of attention separately as frequency measures and included parent responses such as *coaxing* (e.g., "Come on, take a bite," "You can do it"), *threats* to remove preferred tangible items (e.g., "If you don't take a bite, I will take away the toy") or present a potentially aversive stimulus (e.g., "Take a bite or you'll have to take another sip"), *reprimands* (e.g., "Don't spit that out!"), *statements of concern or comfort* (e.g., "You're okay," "Don't cry"), and *praise* (e.g., "good job!"). General attention (e.g., conversations between parent and child) was scored but was not included in the analyses because more specific forms of attention relevant to the target behavior are typically provided during functional analyses. Observers scored meal presentation as a duration measure and defined it as

the parent presenting a spoon or cup in front of the child's face or mouth.

Data collectors scored *spoon or cup removal* as a duration measure, which was defined as the parent removing the spoon or cup from in front of the child's face or mouth for at least 3 s following presentation. Spoon removal was no longer scored when the parent moved the spoon toward the child's mouth following the initial presentation and subsequent removal (i.e., this behavior was scored once per presentation). Observers scored spoon and drink removal separately and later combined these measures (for data analysis purposes) to provide an overall measure of removal. The participants for whom parents presented drinks had a history of refusing both solids and liquids, and because parents typically switched between presenting solids and drinks, combining the two measures seemed to provide a better representation of parental behavior for the entire meal. We defined *spoon or cup presentation* as the parent moving the spoon towards the child's mouth. Observers scored the child *leaving the area* each time the parent did not redirect the child to return to his or her seat after the child left the table and stepped away from the table for at least 3 s. If the parent used a high chair or Rifton chair for a child during the meal, the child did not have the opportunity to leave the area. Observers did not score meal termination during the session, but it was calculated during data analysis.

Data collectors scored *tangible delivery* each time the parent provided the child with access to a leisure item or activity (e.g., toys, videos) to which the child did not have previous access. That is, each time the parent presented the child with an item that was not currently in close proximity to the child, tangible delivery was scored. *Edible delivery* was scored in three different ways. We defined *switching foods* as the parent presenting food reported to be preferred or previously consumed following presentation of a novel food. We defined *drink*

presentation as the parent presenting a drink following food presentation (switching from food presentation to drink presentation). Finally, we defined *food presentation* as the parent presenting food following drink presentation (switching from drink presentation to food presentation).

Data Analysis

Data collectors analyzed the descriptive data to assess the conditional probability values of subsequent events (i.e., the likelihood of parental responses) following children's food refusal and food acceptance. We calculated unconditional probability values to determine the background probability of each event. Finally, in an attempt to determine how frequently parental responses were observed, the percentage of participants for whom each parental response was observed was summarized.

Conditional probability analyses. Data collectors calculated conditional probability values using methods described in previous research (Borrero & Borrero, 2008; Sloman *et al.*, 2005; Vollmer *et al.*, 2001), using a computerized data-analysis program. Each instance of food refusal or food acceptance was considered an opportunity for the subsequent event to be observed. We calculated subsequent events using a binary system (occurred or did not occur) if the delivery of the event occurred within 10 s of a child's response. A window of 10 s was selected based on values reported in previous research (e.g., Sloman *et al.*). The conditional probability value of each event was calculated given (a) combined food refusal, (b) food acceptance, and (c) each topography of food refusal. For example, the probability of parental coaxing given all forms of refusal was calculated, and the probability of parental coaxing given disruption, gagging or coughing, or expelling food was calculated separately. To calculate the conditional probability value of each event (e.g., coaxing, reprimands, spoon removal), the number of times the event was

observed following the child response (within 10 s) was divided by the number of times the behavior occurred (opportunities). Thus, if 25 instances of gagging were observed during the observation, and statements of concern were provided within 10 s of gagging on 15 occasions, then the conditional probability value of statements of concern following gagging would be $p = .60$.

Data collectors calculated all conditional probability values in this manner, with the exception of the conditional probability of meal termination given refusal or acceptance. To complete this calculation, meal termination for each observation was recorded when the last response observed prior to the end of the meal (i.e., the final instance of spoon or drink removal, without re-presentation) occurred within 10 s of the end of the meal (i.e., in this calculation, the number of meals served as the denominator). A binary system was used to complete this calculation. For example, if the last response observed before the final spoon removal was disruption for two of three meals and gagging for one of three meals, the conditional probability of the parent ending the meal given food refusal (either disruption, gagging, expelling food, emesis, or problem behavior) would be 3 divided by 3 or 1.0, the conditional probability of the parent ending the meal given disruption would be 2 divided by 3 or .67, and the conditional probability of the parent ending the meal given gagging would be 1 divided by 3 or .33.

Unconditional probability analyses. Data collectors calculated unconditional probability values to determine how likely it was that each subsequent event occurred throughout the observations without taking into account children's responses. For this calculation, the number of intervals in which the event was observed was divided by the total number of intervals in the observation. As with the conditional probability calculations, 10-s intervals were used to score the unconditional

probability. Using this calculation method, each possible 10-s interval was considered an opportunity for the event. The first interval was scored from Seconds 1 through 10, the second from Seconds 2 through 11, the third from Seconds 3 through 12, and so on, and then were combined across observations. All unconditional probability values were calculated in this manner, with the exception of the unconditional probability of meal termination given refusal or acceptance. For this calculation, if no refusal or acceptance was observed during the last 10 s of the end of the meal (e.g., the child was looking at a book), this was considered to be an unconditional termination of the meal. Although this calculation potentially resulted in higher probability values than the more stringent method described above for other conditional probability values, it seemed to identify the more relevant concern: whether or not the meal was terminated following refusal.

Percentage of participants. Data collectors calculated the percentage of participants for whom each subsequent event was observed following food refusal or acceptance using a binary system (i.e., if $p > 0$, the event was observed for that participant, and if $p = 0$, the event was not observed for that participant). Although this calculation did not take into account high or low conditional probability values, the purpose of this calculation was simply to determine how often an event was observed, rather than the likelihood with which it was observed. For each calculation, the percentage of participants for which an event was observed was calculated by dividing the number of participants with $p > 0$ for that event by the total number of participants. When analyzing data for the separate topographies of food refusal, the number of participants differed depending on the number of participants with an opportunity for the event to be observed. For example, when calculating the conditional probability of parental coaxing given gagging, only participants who engaged

in gagging could be included in this analysis, in that there was no opportunity for coaxing to occur following gagging if gagging was not observed (i.e., the conditionality was not met). Children seated in a high chair or Rifton chair did not have the opportunity to leave the area (i.e., walk away from the table) and were not included in this calculation. Data collectors also completed these calculations for overall food refusal, acceptance, and the separate topographies of food refusal.

Interobserver Agreement

Interobserver agreement was scored by having a second data collector independently score videotaped meals, collecting data on both children's and parents' responses. Data were calculated using the partial-agreement-within-intervals method (e.g., Iwata, Pace, Cowdery, & Miltenberger, 1994). Each observation was divided into 10-s intervals, and agreement between both observers was assessed across each interval. The smaller number (in each 10-s interval) was divided by the larger number, and a mean was calculated for the entire observation. Interobserver agreement was calculated for 40% of meals across all participants (range, 33% to 100%). Individual agreement scores are available from the first author.

For all participants, mean agreement for children's behavior was 98% for disruption (range for all participants, 93% to 100%), 99% for gagging and coughing (range, 87% to 100%), 99.9% for expelling food (range, 98% to 100%), 99.7% for emesis (range, 93% to 100%), 99.9% for severe problem behavior (range, 98% to 100%), 99.9% for leaving the area (range, 99% to 100%), and 99% for acceptance (range, 96% to 100%). Mean agreement for parental attention responses was 96% for coaxing (range, 87% to 100%), 99.9% for threats (range, 98% to 100%), 99% for reprimands (range, 88% to 100%), 99% for statements of concern and comfort (range, 93% to 100%), and 97% for praise (range, 79% to 100%). Mean agreement for parental tangible

delivery responses was 99% for delivery of leisure items (range, 93% to 100%), 97% for presentation of previously consumed foods (range, 72% to 100%), 98% for presentation of novel foods (range, 86% to 100%), 99.7% for drink presentation (range, 97% to 100%), and 98% for spoon presentation (range, 89% to 100%). Mean agreement for parental escape responses was 95% for spoon removal (range, 82% to 100%) and 97% for cup removal (range, 80% to 100%).

RESULTS

Observations began during the first meal and occurred across two or three meals for each participant (i.e., 1 to 2 days). Total observation time across participants was 1,146.5 min, with a mean of 45.9 min (range, 9.7 min to 120.7 min). Over the course of the study, 73 meals were observed for approximately 19 hr of observation (range, 10 min [three meals] to 121 min [three meals]) with a mean of 45.9 min per meal. For all of the meals observed, the total observation time of spoon or drink presentation was approximately 11 hr (range, 5.5 min [three meals] to 72.2 min [three meals]) with a mean of 27.2 min. Mean instances of food refusal for all participants was 175.8 (range, 16 to 542), and mean instances of food acceptance for all participants was 74.4 (range, 5 to 290).

The results of the conditional probability analyses for all participants are shown in Figures 1 through 4 (individual probability values for each participant are available from the first author). For all figures, the results are shown for all participants given the specific form of parental attention (top), the specific form of parental tangible delivery (middle), and the specific form of parent-granted escape from the mealtime context (bottom). Figure 1 shows the probability of a subsequent event given refusal or acceptance and the unconditional probability of each subsequent event summed across all 25 participants. Results of these

analyses showed that although all forms of attention were observed following food refusal, coaxing was most likely ($p = .34$). Coaxing also was most likely following acceptance ($p = .07$). Threats were the only form of attention not observed following acceptance and relatively low levels of concern or comfort occurred. Regardless of the type of attention, it is notable that the probability of each subsequent event was higher following food refusal than food acceptance. In addition, the conditional probability values for subsequent events following food refusal were all higher than the unconditional probability values for all events.

Delivery of tangible items also occurred during the descriptive observations, although the probability values were relatively low across all events. For example, the most likely event observed following refusal was the presentation of food after presenting a drink ($p = .09$), and all forms of tangible delivery were more likely following refusal than acceptance. In addition, the conditional probability value for the presentation of leisure items following refusal ($p = .05$) was higher than the probability following acceptance ($p = .0004$) and the unconditional probability ($p = .01$). The probability of drink presentation following food presentation was higher following refusal ($p = .04$) than following acceptance ($p = .01$) and the unconditional probability ($p = .03$). The unconditional probability of the presentation of previously consumed foods ($p = .55$) and the presentation of food following drink presentation ($p = .22$) were higher than the conditional probability values of both events following refusal ($p = .07$ and $p = .09$, respectively) and acceptance ($p = .03$ and $p = .07$, respectively).

Various forms of escape from the mealtime situation were observed, with meal termination following food refusal occurring most often ($p = .79$) compared to spoon or cup removal ($p = .56$). Spoon or cup removal was the most common event that followed acceptance ($p =$

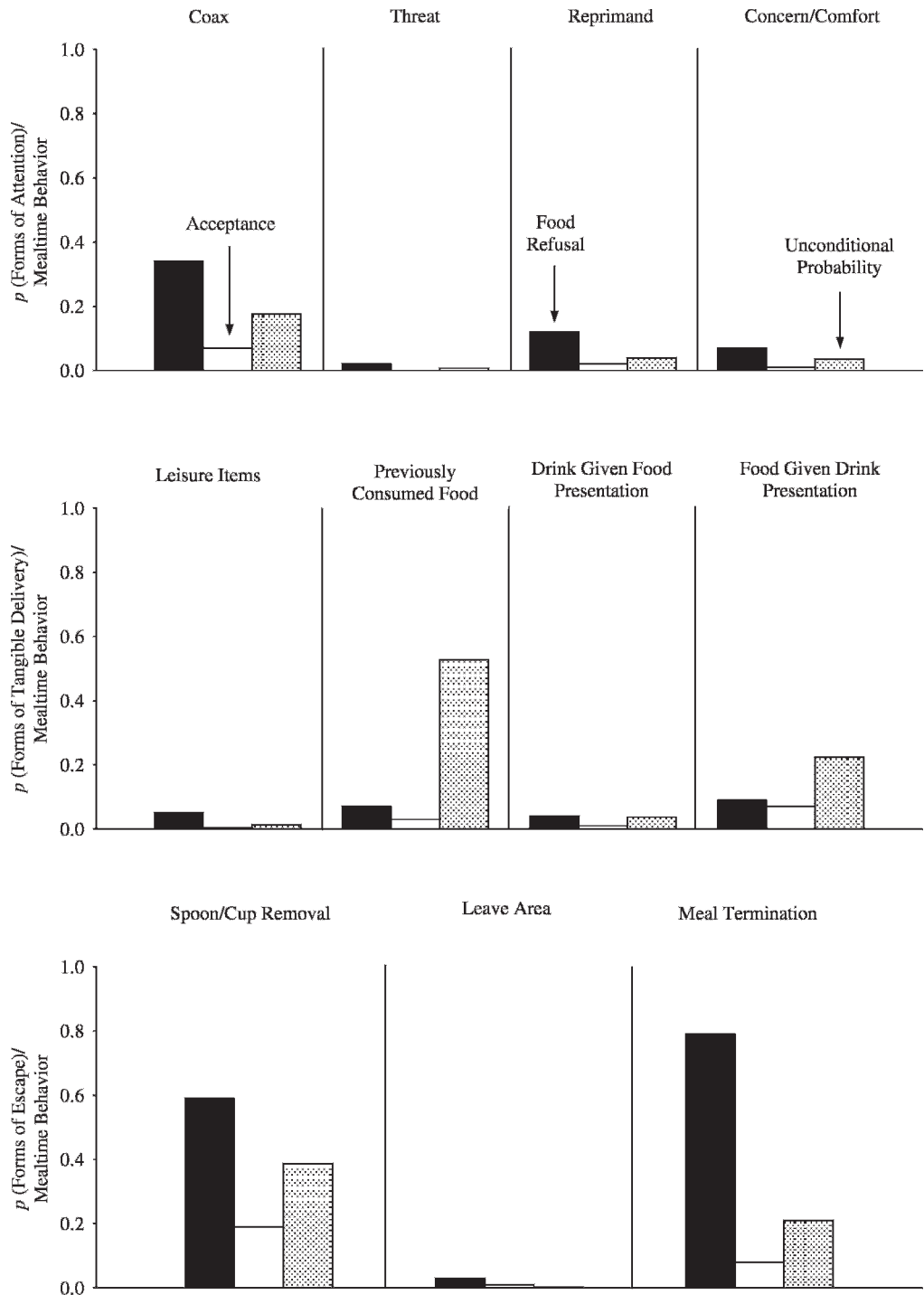


Figure 1. Probability of subsequent events. Conditional probability values of events following food refusal (black bars), food acceptance (white bars), and the unconditional probability of events (dotted bars) for all participants. Probability values are shown for specific forms of attention (top), delivery of tangible items (middle), and escape (bottom).

.19). Across all events, however, the probability of each was higher following food refusal than following food acceptance. Finally, the conditional probability values were higher than the unconditional probability values for all subsequent events. Across all categories of attention, tangible delivery, and escape, the events that were most likely to follow food refusal were termination of the meal, spoon or cup removal, and coaxing.

Figure 2 shows the percentage of participants for whom each subsequent event was observed at any time during the descriptive observations. All subsequent events were observed with at least 1 participant. In terms of forms of attention, coaxing was the most common type of attention following both food refusal (92%) and acceptance (76%) across all participants. Presentation of previously consumed food was the most common form of tangible delivery for both food refusal (62%) and acceptance (33%) across participants and was the most common event to follow food refusal overall, although presentation of food after drink presentation given food refusal (56%) occurred at similar levels. Spoon or cup removal was the most commonly observed event following food refusal (100%) and acceptance (92%), although meal termination given food refusal (96%) also was observed at high levels. Overall, forms of parental attention (i.e., coaxing, reprimands, and statements of concern or comfort) and escape (i.e., spoon or cup removal and meal termination) were more common across participants than forms of tangible delivery.

Figure 3 shows the probability of a subsequent event given specific topographies of refusal including disruption, gag and cough, expulsion, emesis, problem behavior (i.e., SIB or aggression), or acceptance for all 25 participants. Results for forms of attention showed that the probability of coaxing was highest given disruption ($p = .35$) and expulsion ($p = .33$) and was relatively low following other child responses. Threats occurred at relatively low levels across all

responses. The probability values for reprimands were highest given expulsion ($p = .41$), emesis ($p = .33$), and problem behavior ($p = .52$). Statements of concern and comfort were most likely given emesis ($p = .61$) and problem behavior ($p = .32$). Results for the delivery of tangible items were relatively low across all events, and the most likely events were presenting previously consumed foods given expelling food ($p = .81$) and gagging or coughing ($p = .33$) and the delivery of leisure items given emesis ($p = .22$). Results of the analyses of escape from the mealtime context showed that the probability of ending the meal following food refusal was highest given disruption ($p = .68$); the probability of spoon or cup removal was relatively high across problem behavior ($p = .55$), disruption ($p = .50$), expelling food ($p = .45$), and gagging or coughing ($p = .35$). In general, the results suggested that parents were more likely to reprimand following problem behavior and expelling food and were more likely to provide statements of comfort and concern following emesis and problem behavior. Parents were also likely to remove the spoon or cup following all forms of food refusal, with the exception of emesis, and were most likely to end the meal following disruption.

Figure 4 shows the percentage of participants for whom each subsequent event was observed following each topography of food refusal and acceptance during the descriptive analyses. Coaxing was observed for the most participants and followed all forms of behavior (with the exception of emesis) for 45% or more of participants. Threats were observed the least often and were observed only following disruption, acceptance, and gagging or coughing for 6% or more of participants. Reprimands were observed following all forms of behavior for 31% or more of participants. Statements of concern or comfort were observed following all forms of behavior for 24% or more of participants. Presentation of previously consumed food was observed following all forms of

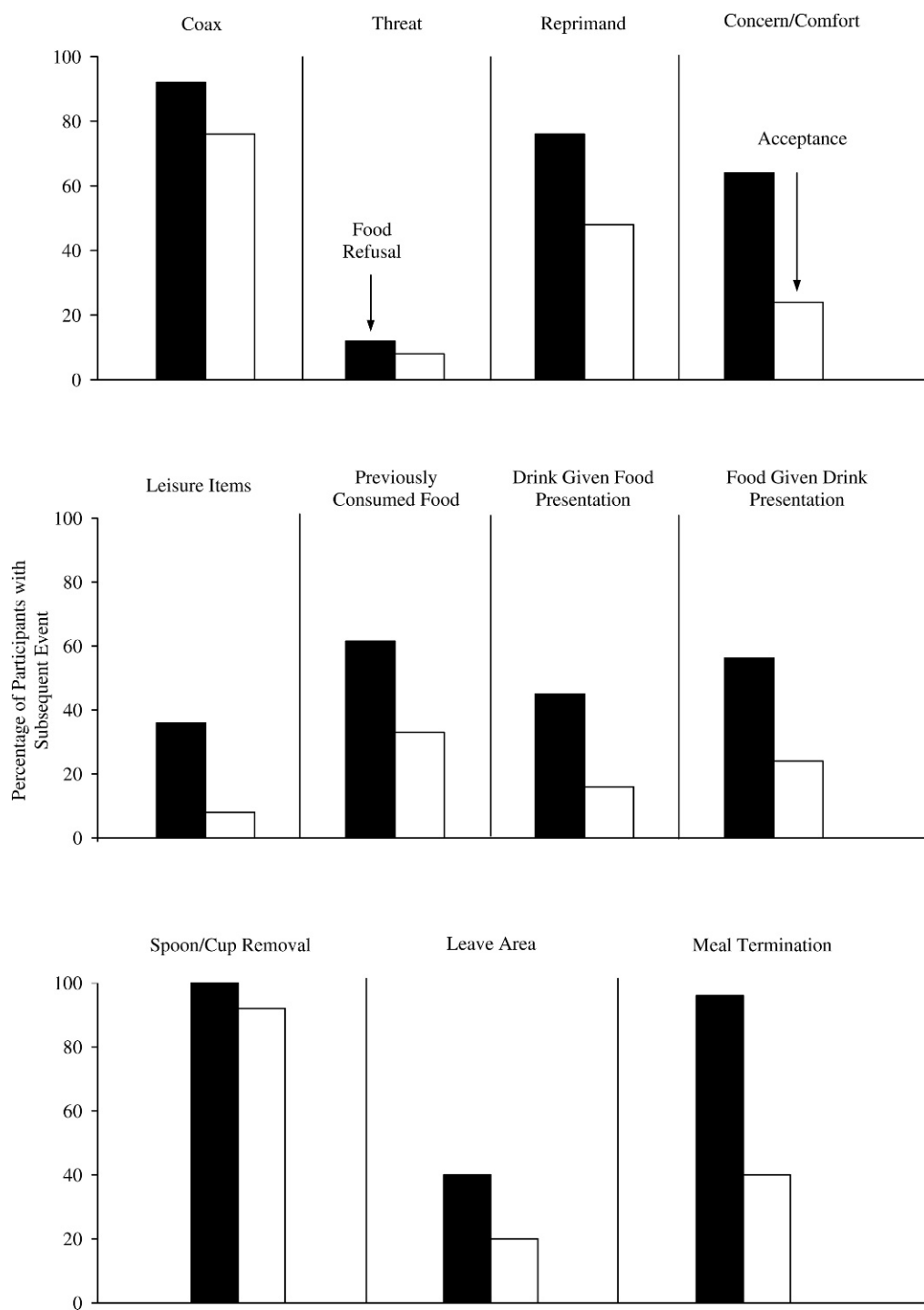


Figure 2. Percentage of participants for whom forms of attention (top), delivery of tangible items (middle), and escape (bottom) were observed following food refusal (black bars) and food acceptance (white bars) during the descriptive analyses.

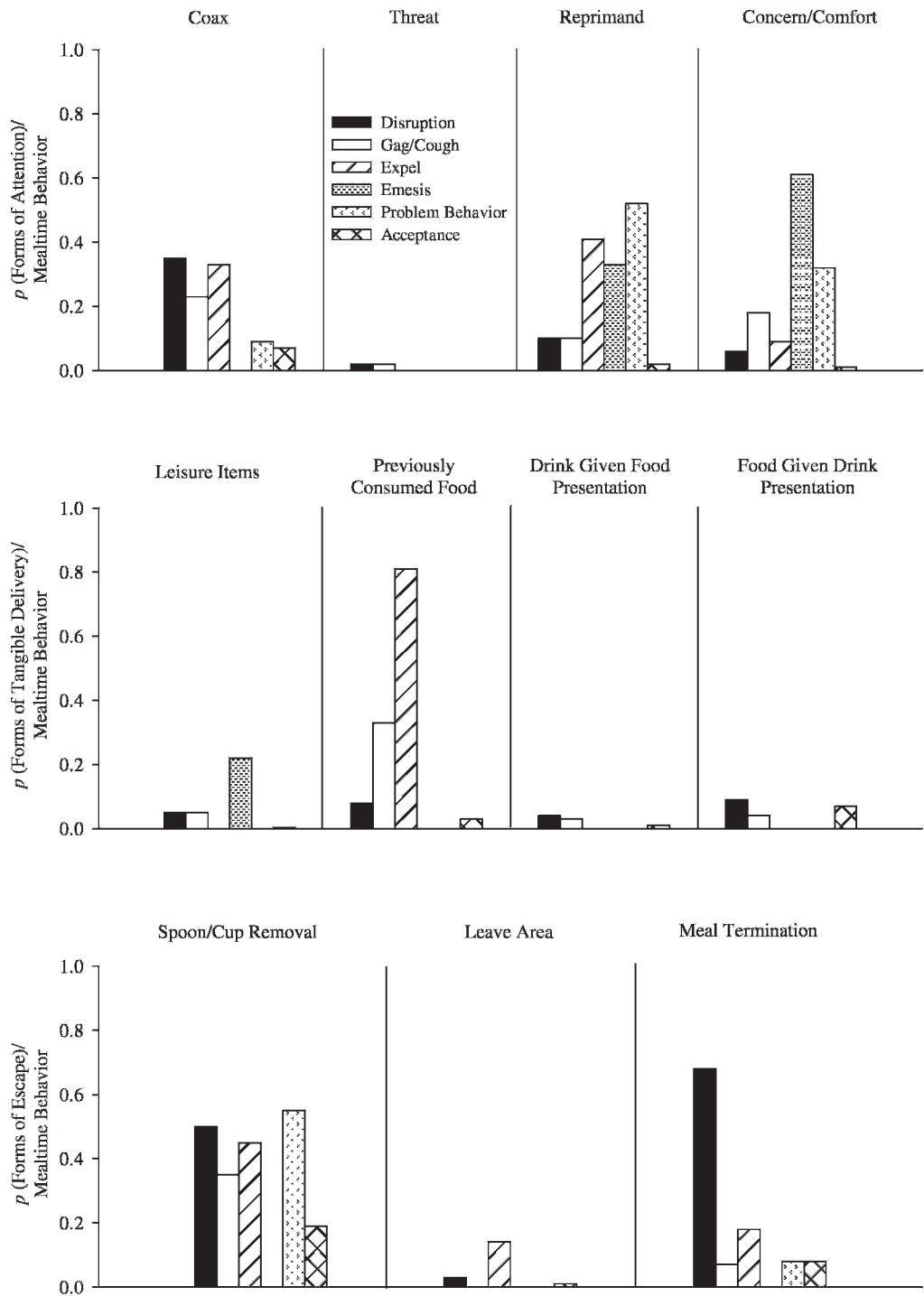


Figure 3. Probability of subsequent events. Conditional probability values of events following disruption (black bars), gagging or coughing (white bars), expelling food (striped bars), emesis (dotted bars), problem behavior (arrowed bars), and food acceptance (checked bars) for all participants. Probability values are shown for specific forms of attention (top), delivery of tangible items (middle), and escape (bottom).

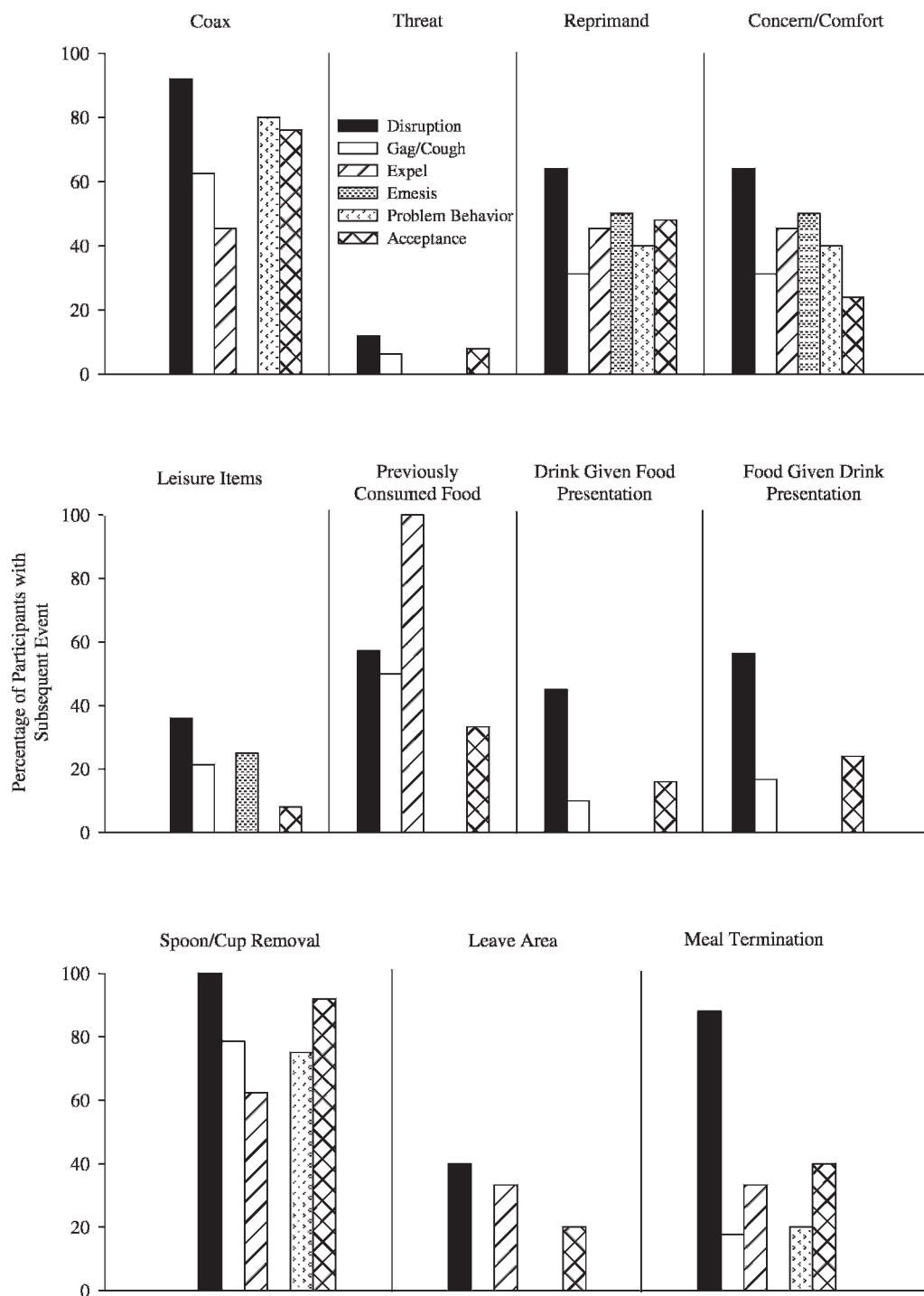


Figure 4. Percentage of participants for whom forms of attention (top), delivery of tangible items (middle), and escape (bottom) were observed following disruption (black bars), gagging or coughing (white bars), expelling food (striped bars), emesis (dotted bars), problem behavior (arrowed bars), and food acceptance (checked bars) during the descriptive analyses.

behavior (with the exception of emesis and problem behavior) for 33% or more of participants. Presentation of leisure items was observed for all forms of behavior (with the exception of expulsion and problem behavior) for 8% or more of participants, and the presentation of a previously consumed food was observed following all forms of behavior (with the exception of emesis and problem behavior) for 33% or more of participants. Presentation of drinks given food presentation was observed following the same forms of behavior for 10% or more of participants, and presentation of foods following drink presentation was observed given disruption, acceptance, and gagging or coughing for 17% or more of participants. Spoon or cup removal was observed following all forms of behavior (with the exception of emesis) for 63% or more of participants. The parent allowing the child to leave the mealtime context was observed only given disruption, expelling food, and acceptance for 20% or more of participants. Finally, meal termination was observed following all forms of behavior (with the exception of emesis) for 18% or more of participants. In general, all events were observed across responses, and all but one event followed disruption for most of the participants.

DISCUSSION

Descriptive analyses were conducted for 25 parent-child dyads for whom a history of feeding difficulties was reported. Data on child and parent behavior were collected, and conditional probability values of subsequent events following child behavior were compared to the conditional probability values of the same event given acceptance and the unconditional probability of each event. The results of the current investigation are consistent with those of Piazza, Fisher, et al. (2003) in that parents of children with severe food refusal may engage in various responses (coaxing, threatening to take away preferred items, or presenting preferred

foods) to increase the likelihood that the child will eat. The current investigation demonstrates that the form of subsequent events described in previous research and those that are typically included in the design of functional analysis test conditions are provided fairly often during naturalistic observations in a hospital setting. One criticism of analogue functional analyses has been that the conditions do not resemble those in more naturalistic settings (Sturme, 1995). However, in the present investigation, parents frequently provided attention in various forms, removed the spoon or cup from the child's mouth, and terminated the meal rather quickly following food refusal. In addition, although the data are not presented in this investigation, when parents removed the spoon following food refusal, they eventually did represent the bite, which is nearly identical to the manner in which the escape condition of a functional analysis has been described in the literature on feeding disorders (Piazza, Fisher, et al.).

Similar to the results of Piazza, Fisher, et al. (2003), the results of the current investigation suggest that escape (in the form of spoon removal and meal termination) and attention (including coaxing, reprimands, and comfort or concern) were the most frequently observed parental responses to food refusal. The results suggest that future research should also consider including more specific forms of attention, tangible delivery, and escape in analogue functional analyses based on results from a descriptive analysis. If a parent provides comfort following food refusal, and the attention condition of the functional analysis includes coaxing, it is possible that an attention function would not be identified. Results from the descriptive analysis may help to design more idiographic functional analyses by implementing contingencies more similar to the natural environment. Despite the obtained results, it should be noted that the extent to which the results of descriptive analyses provide informa-

tion regarding the function of food refusal is currently unknown, and future research should evaluate the correspondence between the two methods of assessment.

Similar to the outcomes presented by Thompson and Iwata (2001), the present results indicated that caregiver responses may differ depending on the topography of problem behavior. It is not surprising that parents provided the most statements of concern or comfort following emesis and problem behavior or switched to a previously consumed food when the child expelled another food. On the other hand, it seems unusual that parents did not remove the spoon or cup or end the meal following emesis. Although most parents with children who eat without difficulties would likely remove any demands to eat following emesis, perhaps the unique history of parents of children with food refusal produced this unexpected finding. To illustrate, these parents are often concerned with ensuring appropriate caloric intake, so they continue to feed through episodes of emesis, sometimes even making up the calories by presenting additional food at a meal. It could also be that parents had been provided with advice or recommendations by physicians or practitioners prior to admission, or that they were simply reacting to being observed and did not respond to their child's food refusal as they would outside of the hospital setting. Finally, it is possible that the spoon was not present at the child's mouth when emesis occurred. Food refusal may have occurred prior to the bite being placed in the mouth or following bite placement. If emesis occurred after bite placement, it is possible that the parent may have delayed the next spoon presentation, which would not have been accounted for by the calculations for spoon removal.

It is also noteworthy that for all calculations, the conditional probability values were higher following food refusal than following food acceptance, and all but 5 participants engaged

in more food refusal than food acceptance. Although it was not measured, it is possible that food refusal was reinforced more frequently than food acceptance, and this may have affected the number of instances of refusal observed. Also, with the exception of the presentation of previously consumed foods, the conditional probability values were higher following food refusal than the unconditional probability values. This may suggest that possible reinforcers were most likely to follow food refusal. Because more than one event could occur at the same time, it may be the case that the events interacted in such a way that the child allocated his or her behavior toward one response alternative. It is possible that the quality of potential reinforcers differed (e.g., reprimands vs. comfort or praise vs. termination of the meal), or that multiple events presented at the same time affected the quality of the event. This type of arrangement (i.e., a concurrent-schedules arrangement) may result in a child choosing to allocate his or her responding to the more reinforcing alternative, possibly the alternative that seemingly favors food refusal. It is also possible that the parents arranged the mealtime context to favor food acceptance by presenting only reportedly preferred foods. Although we did not calculate the occurrence of more than one subsequent event at any given time (e.g., the probability of spoon removal and reprimands occurring together), future research could include such calculations to determine how children respond when one or more potential reinforcers are delivered at the same time and how this could affect responding. Additional research on various parameters of reinforcement (e.g., quality, latency to reinforcement) may also yield useful information.

One limitation of this research is that no functional analyses were conducted for the children; therefore, no reinforcers were identified for each child, and thus it is not clear if any of the parental responses functioned as rein-

forcers for food refusal (or acceptance). Even though this is true of all descriptive research, in an effort to account for as many potential reinforcers as possible, parental responses of interest included various ways that attention, tangible items, or escape could be delivered, specifically as they related to pediatric food refusal. Much of the research in pediatric feeding disorders has demonstrated that escape is frequently found to be a reinforcer for food refusal, often in combination with additional reinforcers (e.g., Anderson & McMillan, 2001; Bachmeyer *et al.*, 2009; Dawson *et al.*, 2003; Mueller, Piazza, Patel, Kelley, & Pruett, 2004; Patel, Piazza, Martinez, Volkert, & Santana, 2002). It must be stressed that the intent of the current investigation was not to suggest that these subsequent events functioned as reinforcers, but to determine how frequently these potential reinforcers occurred in more naturalistic situations. Additional research in this area may involve identifying reinforcers for food refusal via functional analyses and using those results to determine how known reinforcers are delivered during descriptive observations with caregivers and children.

Another potential limitation of this investigation was the use of a 10-s window to determine if an event occurred following a child response. This difficulty may be highlighted with the example of the probability of reprimands given food acceptance, which does not seem like a typical parental response to appropriate behavior. Reprimands were observed following food acceptance ($p = .02$) for 48% of participants. Additional calculations showed that praise also followed acceptance ($p = .18$) for 80% of the children, which seems like a more logical parental response to appropriate behavior. By using a 10-s window, all parental responses that followed child behavior were included in that 10 s. If a smaller window had been used, such as a 1-s window, the results would have been different. This window was chosen arbitrarily, based on

previous research in this area (Borrero & Borrero, 2008; Sloman *et al.*, 2005; Vollmer *et al.*, 2001); however, it is possible that smaller windows may yield different results. Future research may assess conditional probability values using different time windows to determine if there is an ideal window to use for such analyses.

As can sometimes be the case with observations of parent-child interactions, it is possible that the parents' behavior differed from that which occurred in the home setting. Not all parental responses were included in this investigation; therefore, the subsequent events described were selected based on their similarity to those presented during functional analyses of inappropriate mealtime behavior. Additional parental responses were scored (e.g., force feeding, physical assistance); however, based on the low frequency with which these responses occurred, they were not included in the analyses.

The fact that the descriptive observations were not scripted in any way (e.g., Anderson & Long, 2002) may have limited the sample of responses. Some meals were very short in duration and few instances of food refusal, acceptance, or bite presentation were observed. Although it was possible to have the parents conduct the meals for a prespecified period of time or present bites on a fixed-time schedule, the purpose was to observe what parents did when feeding their children, and it seemed more appropriate to give minimal instructions. Child responses may have been limited as well. Only a few children actually vomited during meals, rather surprising for an intensive feeding unit where this is a common complaint of parents. It is possible that the parental responses prevented more severe forms of food refusal, such as expelling food or emesis. Often the parent removed the spoon without the child accepting the food, so perhaps there were fewer opportunities for the child to expel food or have emesis. This highlights just how difficult it is for

parents to continue presenting food to their children when they engage in food refusal and may also provide information that can guide parent training at a later time.

It should be noted that this investigation took place in an intensive program to assess and treat pediatric food refusal and selectivity. The selection of participants could have affected the results because these children's food refusal was severe enough to warrant admission to an intensive program lasting 6 to 8 weeks. It is possible that the sample included children who engaged in much higher levels of food refusal, resulting in chance pairings of events with food refusal. It is also possible that similar results would not have been observed with children who exhibited less severe food refusal (e.g., outpatient cases), and that parental strategies may differ for less severe cases. The level of food refusal and acceptance differed across participants and covered a broad range, suggesting that the severity of food refusal may have differed.

Finally, the focus of this investigation was on the likelihood of parental responses following children's responses. Perhaps equally useful information could be provided by determining the likelihood of children's responses following parental responses. That is, some parents verbally reported that their tactics were successful in getting their child to consume more food, such as coaxing, or that removal of the spoon following gagging allowed the child more time to swallow without emesis. Analyses of this type may give insight into children's food refusal and acceptance following parental responses.

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